Appendix 1

GO product specification

5　**Introduction**

Go is a stand-alone fully integrated personal navigation device. It will operate independently from any connection to the vehicle.

Target markets

Go is indented to address the general personal navigation market. In particular it is

10　designed to extend the market for personal navigation beyond the "early adopter" market. As such it is a complete stand-alone solution; it does not require access to a PC, PDA or Internet connection. The emphasis will be on completeness and ease of use. Although Go is a complete personal navigation solution it is primarily intended for in vehicle use. The primary target market is anybody who drives a vehicle either for

15　business or pleasure.

To successfully address this market Go must satisfy the following top-level requirements:

1. Acceptable price point - Appropriate compromise between product features and cost.
2. Simplicity – Installation and operation of Go will be simple and intuitive, all

20　major functions should be accomplished by an average non PC-literate user without recourse to the product manual.
3. Flexibility – All map data and operating programs will be supplied on plug in memory cards. The device can easily be extended to cover different locals.
4. Reliability – Although in-car navigation systems are not considered safety critical

25　components users will come to rely on Go. It will be engineered to all relevant automotive environmental standards. In addition it will be tolerant to short GPS coverage outages.

Channels

- Consumer electronics retail outlets

30　• Automotive accessory outlets
- Specialist car accessory fitting garages

Product summary

Go is an in-vehicle personal navigation device. It is designed as an appliance, that is, for a specific function rather than a general purpose one. It is designed for the consumer after-

sales automotive market. It will be simple to use and install by the end user, although a professional fitting kit will be optionally supplied.

The principal features are:

- Built on standard commodity PocketPC 2002 components

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- Standard PocketPC 3.5" ¼VGA transflective TFT LCD display mounted in landscape orientation

- Romless soft-boot memory architecture

- Highly integrated ARM9 200MHz CPU

10 - SD card memory slot for application and map data storage

- Integrated GPS receiver and antenna

- Integrated two axis accelerometer for simple dead reckoning

- Power, audio, debug and external GPS antenna connections made through docking connector on base of unit

15 - Embedded Linux OS with no GUI layer, application provides its own UI

- Very simple touch screen UI optimised for finger use

- High quality integrated speaker for voice instructions

- Internal rechargeable Li-Ion battery giving at least five hours of continuous operation

20 **Operating System**

Go will use a customised version of embedded Linux. This will be loaded from an SD card by a custom boot-loader program which resides in Flash memory

Hard buttons

Go will have only one hard button, the power button. It is pressed once to turn on or off

25 Go. The UI will be designed so that all other operations are easily accessible through the pen based UI.

There will also be a concealed hard reset button.

Architecture

Go architecture is based around a highly integrated single chip processor designed for

30 mobile computing devices. This device delivers approximately 200 MIPs of performance from an industry standard ARM920T processor. It also contains all the peripherals required excluding the GPS base-band. These peripherals include DRAM controller, timer/counters, UARTs, SD interface and LCD controller.

The main elements of this architecture are:

- Microprocessor running at 200MHz
- 32MB or 64MB of fast synchronous DRAM (SDRAM) with low power self refresh. Arranged as two devices on a 32 bit wide 100MHz bus
- SD card interface for all non-volatile storage including the OS (No RAM drive)
- Native (bare metal) boot loader stored in 256KB of NOR Flash. This Flash device will contain a boot sector which is write protected to store protected data such as unique product ID's and manufacturing data.
- Debug UART (RS232 3V levels) connected to the docking connector
- USB client for PC connectivity
- Integrated GPS receiver
- Integrated two axis accelerometer
- Optional integrated Bluetooth transceiver for PDA and mobile phone connectivity
- High quality audio through I^{2}S codec and amplifier

The Go block diagram is at **Figure 7**.

Power management

Go will be powered from an integrated Li-Ion 2200 mAH rechargeable battery. This battery can be charged, and the device powered (even if the battery contains no charge) from an externally supplied +5V power source. This external +5V power source is supplied via the docking connector or a DC jack socket.

This +5V supply will be generated from the vehicle's main supply rail or from a mains adapter externally. The device will be turned on and off by a single button. When the device is turned off the DRAM contents will be preserved by placing the RAM in self-refresh so that when switched on Go will resume from where it was switched off. There will also be a wake-up signal available through he docking connector, this can be used to auto-switch on Go when the vehicle ignition is switched on.

There will also be a small hidden reset switch.

System Memory architecture

In contrast to conventional embedded devices which execute all the OS and application code in place from a large mask ROM or Flash device, Go will be based on a new memory architecture which is much closer to a PC.

5 This will be made up of three forms of memory:

4. A small amount of XIP (eXecute In Place) Flash ROM. This is analogous to the PC's BIOS ROM and will only contain a proprietary boot loader, E^2 emulation (for UID and manufacturing data) and splash screen bit maps. This is estimated to be 256 KB in size and would be on a slow 8 bit wide SRAM interface.

10 5. The main system memory, this is analogous to the PC's main memory (RAM). This will be where all the main code executes from as well as providing the video RAM and workspace for the OS and applications. **Note:** No persistent user data will be stored in the main system RAM (like a PC) i.e. there will be no "Ram drive". This RAM will be exclusively connected to a 32bit 100MHz synchronous high-speed bus. Go will contain two sites for 16 bit wide 256/512Mbit SDRAM's allowing memory configurations of 32MB (16 bit wide) 64MB 32 bit wide and 128 MB (32 bit wide).

6. Non-volatile storage, analogous to the PC's hard disk. This is implemented as removable NAND flash based SD cards. These devices do not support XIP. All the OS, application, settings files and map data will be permanently stored on SD cards

Audio

A 52 mm diameter speaker is housed in Go to give good quality spoken instructions. This will be driven by an internal amplifier and audio codec. Audio line out will also be

25 present on the docking connector.

SD Memory slot

Go will contain one standard SD card socket. These are used to load system software and to access map data.

Display

30 Go will use a transflective 3.5" TFT backlit display It will be a 'standard' ¼VGA display as used by PocketPC PDA's. It will also contain a touch panel and bright CCFL backlight.

Power supplies

Power supply – AC adapter socket

4.75V to 5.25V (5.00V +/- 5%) @ 2A

Power supply – Docking connector

5   4.75V to 5.25V (5.00V +/- 5%) @ 2A

Variants

It shall be possible to assemble and test the following variants of Go:

Standard (Bluetooth depopulated, 32Mbyte RAM)

In the Standard variant the Bluetooth function is not populated, and 32 Mbytes RAM is

10   fitted.

Bluetooth option (Future variant)

The product design should include Bluetooth although it is not populated in the standard

variant to minimise BOM cost. The design should ensure that all other functions

(including GPS RF performance) operate without degradation when the Bluetooth

15   function is operating.

64Mbyte RAM option (Future variant)

The product design should ensure it is possible to fit 64Mbyte RAM instead of 32Mbyte.

Subassemblies

Go consists of the following electrical subassemblies, shown in **Figure 8**.

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RF cable

The RF cable feeds the RF signal from an external GPS antenna (which connects to Go

via the RF docking connector) to the RF PCB where the GPS module is situated.

External connectors

25   **Docking Connectors**

Two Docking Connectors provide an interface to external Docking Stations.

Docking Connector #1 pinout

Pin	Signal	Dir	Type	Description
1	GND	-	-	Signal and power GND
2	GND	-	-	
3	DOCKSNS1	I/P	PU	Docking Station Sense [0,1] – These signals are connected to pull-up resistors within the unit. The Docking Station pulls either or both of these signals to GND to indicate the presence and type of Docking Station.
4	DOCKSNS0	I/P	PU	
5	AUDIOL	O/P		Audio line outputs (Left and Right) to connect to car audio system.
6	AUDIOR	O/P		
7	MUTE	O/P	O/D	The unit pulls this line to GND to signal the car audio system to mute itself while the unit is issuing a voice command.
8	IGNITION	I/P	PD	Ignition sense.
9	DOCKPWR	I/P	PWR	+5V power from the Docking Station to simultaneously power the unit and charge the battery.
10	DOCKPWR	I/P	PWR	

PWR	Power connection	PU	Pull-Up resistor within the unit
O/D	Open-Drain output	PD	Pull-Down resistor within the unit

Docking Connector #2 pinout

Pin	Signal	Dir	Type	Description
1	TXD	O/P	UART	3V logic level UART signals
2	RXD	I/P	UART	
3	RTS	O/P	UART	
4	CTS	I/P	UART	
5	GND	-	PWR	
6	nTRST	I/P	JTAG	CPU JTAG signals for test and configuration
7	TMS	I/P	JTAG	
8	TCK	I/P	JTAG	
9	TDI	I/P	JTAG	
10	TDO	O/P	JTAG	

RF Docking Connector

The RF Docking Connector allows connection of an external active GPS antenna via a Docking Station.

AC adapter socket

The AC adapter socket allows power to be supplied from a low cost AC adapter or CLA

5   (Cigarette Lighter Adapter).

USB connector

The USB connector allows connection to a PC by means of a standard mini USB cable.

10   **SD card socket**

A hard locking SD card socket suitable for high vibration applications supports SDIO, SD memory and MMC cards.

(Although Go provides hardware support for SDIO, software support will not be available at the time of product introduction)

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Processor

The processor is the ARM920T based SOC (System on chip) operating at approx 200Mhz.

RAM

20   Go will be fitted with RAM to the following specification:

Type	SDRAM with low-power refresh ("mobile" SDRAM)
Total memory	32 Mbyte (standard) or 64 Mbyte (future option)
Bus width	32-bit
Minimum speed	100Mhz
Maximum self refresh current	500 μA per device
Configuration	2 x 16-bit wide CSP sites

Flash Memory

Go will be fitted with a minimum of 256kbyte of 16-bit wide Flash Memory to contain

25   the following:

- Boot loader code to enable loading of O/S from SD card
- Factory set read-only protected manufacturing parameters (e.g. manufactured date) and unique ID (E2PROM emulation)

- User specific settings (E2PROM emulation)

The following devices can be used depending on price and availability.:

GPS internal antenna

5   The GPS internal antenna is attached directly to the RF PCB.

GPS external (active) antenna switching

When an external antenna is connected via the RF Docking Connector, the GPS antenna source is automatically switched to the external antenna.

Accelerometer

10   A solid state accelerometer is connected directly to the processor to provide information about change of speed and direction.

Auxiliary functions

Ignition synchronization

Ignition wakeup

15   A rising edge on the Docking Station IGNITION signal will wakeup the unit. The IGNITION signal may be connected to a 12V or 24V vehicle battery.

Ignition state monitoring

The state of the Docking Station IGNITION signal is detected and fed to a GPIO pin to allow software to turn off the unit when the ignition signal goes low.

20   **Standard peripherals**

The following peripherals will be included as standard with Go.

- Simple docking shoe. Mounts Go and allows charging through a DC jack. No other connectivity is included in the simple dock.
- Cigarette lighter power cable connecting to Go through the DC jack socket or
25   simple docking shoe.
- Mini USB cable for PC connectivity
- Universal mains adapter for connection to DC Jack socket

Optional peripherals

The following optional peripherals will be available at or after the time of launch of Go

30   - Active antenna kit. Contains a GPS active antenna and a docking shoe with GPS RF connector and cable fitted. For self installation when an external antenna is required.

- Professional vehicle docking kit. For fitting by professional installation only. Allows direct connection to vehicle supply, audio system and active antenna via a vehicle interface box.